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MAGNETIC CORRELATIONS IN $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ FROM NQR
RELAXATION AND SPECIFIC HEAT

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ABSTRACT

^{139}La and ^{63}Cu NQR relaxation measurements in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ for $0 \leq x \leq 0.3$ and in the temperature range 1.6 + 450 K are analyzed in terms of Cu^{++} magnetic correlations and spin dynamics. It is described how the magnetic correlations that would result from Cu-Cu exchange are reduced by mobile charge defects related to x-doping. A comprehensive picture is given which explains satisfactorily the x and T dependence of the correlation time, of the correlation length and of the Neél temperature $T_N(x)$ as well as being consistent with known electrical resistivity and magnetic susceptibility measurements. It is discussed how, in the superconducting samples, the mobile defects also cause the decrease, for $T \rightarrow T_C^+$, of the hyperfine Cu electron-nucleus effective interaction, leading to the coexistence of quasi-localized, reduced magnetic moments from 3d Cu electrons and mobile oxygen p-hole carriers. The temperature dependence of the effective hyperfine field around the superconducting transition yields an activation energy which could be related to the pairing energy. New specific heat measurements are also presented and discussed in terms of the above picture.